The Wersi Sound Factory Master Classes

## Master Class 6 : August 2013 : The Matrix – Part I

The next tab section of Sound Factory after Envelope is the LFO/Matrix, so that is the subject of this Master Class. In fact, it is the Matrix which will be the subject of a large number of Master Classes from now on, so each Class will be a part of the Matrix coverage. Let's first of all dispense with the LFO part of the tab so we can just refer to the Matrix from now on.

LFO stands for Low Frequency Oscillator. This is used for providing a vibrato to a sound, essentially, and will be covered much later. There are three LFOs in Sound Factory and we shall be looking at them eventually.

Up to now we've been dealing with aspects of Sound Factory which allow modifications to be made to existing Sample Layers within Sounds. With the Matrix we move on to controlling the structure of the Sound and how it interacts with other parts of the instrument.

Here is a screenshot of the LFO/Matrix tab.

The LFO/Matrix screen
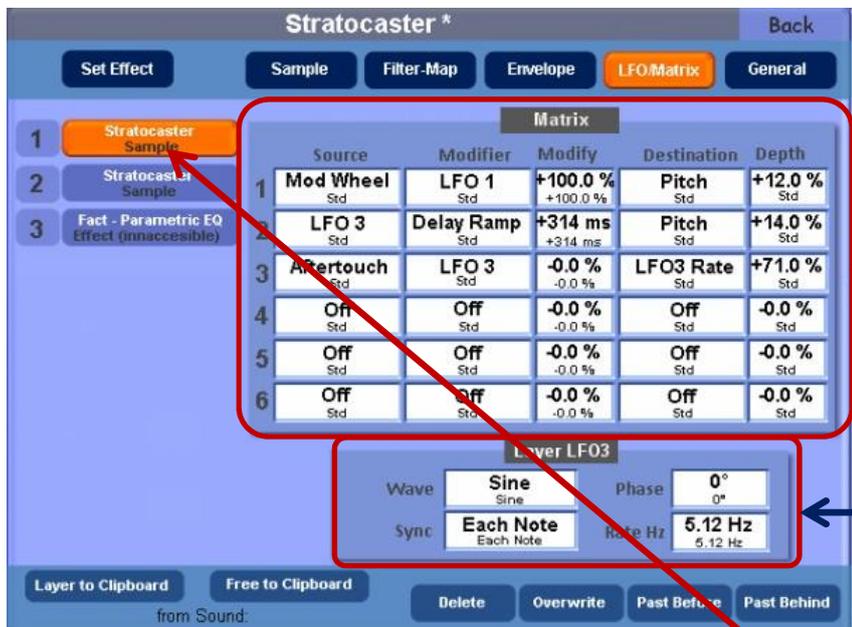
This is the Matrix Table which will form the focus of our attention in this and the coming Master Classes.

This table refers to LFO3 to which we shall return much later. It can be ignored for now.

Points to notice about the Matrix Table:
1. There are six rows. These provide up to six events which can be inserted to control the sample layer selected (highlighted in orange in the layer list on the left).
2. There are five columns: Source; Modifier; Modify; Destination; Depth. These are going to be the centre of our attention. To start with (at the shallow end of the pool!) we can ignore the Modifier and Modify columns.

If you look at the Sound Factory page on the WersiClub International website, in the bottom panel under '21 February 2011' you'll see a download called 'LFO/Matrix'. This lists currently 48 parameters which can be the Source and 10 parameters which can be the Destination. You'll also see my comment "not fully conversant with all these yet!".

I have to say that comment still applies, though with Ian's help over the past year the mists are gradually parting. We hope to extend that experience to you during the course of these Master Classes. Ian continues to provide many experiments to perform on the Matrix in order to understand it. The question is: where to start? Over to you, Ian.

What the Matrix enables us to do

Let's first of all try to understand in general terms what the Matrix enables us to do. It essentially allows the musician/performer/programmer to produce a dynamic/responsive musical instrument/system. The idea behind the Matrix is very simple: you select and connect various components together. These then form/perform a function. This is called Modulation in synth circles, several modulations together being collectively called/known as a Patch. In fact, the Matrix in Sound Factory has more in common with a synthesizer than an organ.

The components that make up the Matrix are from a selection of physical and electronic elements which can then be further classified into various types of families or subgroups/functions. We are able to mix and match these to suit our requirements for each individual sample layer. Then we can add more sample layers together as and when they are required.

In order to get anything to work in the Matrix you will need the following to complete a modulation path or Patch. Once these components are all in place, all the necessary conditions for the Matrix to work are then activated.

These are:

Source, Destination and Numeric components

A Source component, a Destination component, and a numeric value called Depth. Here is an important point to remember: numeric values can be either positive or negative. Source components and Modifier components can be either positive, negative or both. If a Source/Modifier component is producing only positive values or only negative values it is called a Uni-Polar modulation. If the Source/Modifier component is producing values in both the positive and negative value range it is called a Bi-Polar modulation. (Although we're not considering Modifier components just yet, this point is being made here for completeness. Modify is therefore a numeric value, providing the extent of the modification.)

Matrix Experiment 1 - Using the MW to change Pitch

Matrix Experiment 1 - Using the Modulation Wheel to change Pitch

This will confirm the above paragraph. Pick any Orchestral sound for Upper/Select 1, go into Selectors and confirm that your Mod Wheel (MW) is active for Upper 1 only. Then with Upper/Select 1 active, go into Sound Factory and then into Expert Edit.

If your sound has more than one layer, pick any layer and mute the others for now. Play it to confirm you are playing/triggering a sound layer and not an effect layer. Go to the LFO/Matrix page of your active layer, delete any modulation that is in the matrix already (as we don't want anything to interfere with our testing), and in any empty row (eg Row 1) enter the following values:

Row No.	Source	Modifier	Modify	Destination	Depth
1	Mod Wheel	Off	0%	Pitch	+100%

This is therefore Uni-Polar modulation.
When you play your instrument's Upper Manual you should notice that the MW (Mod Wheel) is able to change or modulate the Pitch of this sample layer. In its maximum position you should get an octave above the original. With the MW back at its minimum value the sound should return to its original programmed pitch.

What if we wanted the Pitch to go down an octave instead of up? Change the last box value (Depth) from +100% to -100%. When you move the MW forward now, the sound layer will drop an octave. Bring the MW back to its minimum position and the sound layer will return to normal.

This all works using only two component parameters (Source and Destination) and a single numeric component value (Depth). The Mod Wheel (Source component) modulates the Pitch (Destination component) by 'x' amount; in this case 'x' = +/-100% (Depth component).

This also demonstrates another important point: the combination of a Physical controller/object (the MW) being used to modulate the Pitch value. It is physical because the MW is physically moved by the musician/performer to engage the desired effect. Electronic controller elements are generated by the software being run by the computer in the instrument. We can interact with them as well, but that's for another time...

Now it might have occurred to you that there is already a button dedicated for shifting the sounds up or down in octaves, and you would be right. But there are differences between how the Octave button in question functions and how the Mod Wheel functions and, more importantly, how it can be modified to function.

If you use the Octave button on your instrument, you will either need to press it several times to return the sound to its original Pitch setting or you could repress the Total Preset selector that you are using. The latter, however, might change various other settings (volumes, for example).

By using the Matrix it is just a case of moving the MW to add or subtract the modulation amount required. Another advantage is that it can be programmed to affect only specific layers within the sound itself. You can have different layers move in different directions simultaneously. The Pitch Shift can be any musical or non-musical interval you want, not just Octaves. You can build the sound of a simple church organ which can expand into a wider/larger sounding registration and then return it to its original state, all by using the MW to modulate the pitch of each layer in a sound.

Because the MW is available to all Selectors on the Upper Manual simultaneously, you could have two, three or four (with Selector Plus) large orchestral sections all change their octave positions/settings by moving the MW: a complete rearrangement of the orchestration at a flick of the MW.

I think you will be beginning to see just some of the possibilities of this simple but very effective modulation routing.

If you were to move the Pitch Wheel instead of the MW, you would find (assuming it is assigned in the Total Preset to operate and not be ignored) that this is also a Physical controller, but this one is able to produce values in either the positive or negative value ranges. It is therefore considered to be a Bi-Polar Modulation source.

Now an important word of warning before we go any further!

If you already have Sound Factory activated on an OAS instrument you will want to try out some other possibilities using the example above, and please do. However, there are times when you need to be very, very careful!!!

WARNING!
How to avoid very high volume levels being generated while experimenting

If at any time you choose to use either Amp (which stands for Amplitude; think of it as Volume) or Reso (which stands for Resonance, and this can produce some very loud tones anywhere in the audio frequency spectrum/range) as a Destination for your experiments, please, please be very careful with your ears! When you modulate either of these two, always turn the expression pedal down to a low volume (keep your foot on it!), and then slowly gradually increase the expression pedal value.

You'll find out very quickly if a modulation source is producing anything excessive through your speaker system. Be particularly careful with the use of headphones as you are basically close-coupling the speaker almost directly onto your eardrum!

I hope you have taken the time to read all of this and understand the warning. So now go and have a play...

Thank you, Ian, for that introduction to the Matrix and your first experiment for readers who have Sound Factory to try out. As Ian's "student" in all of this I have to recommend expanding the experiments as Ian has suggested and especially to support his warning about the use of Amp and Reso as Destinations. It's also important to realise that physical controls like the Modulation Wheel do affect all Selectors in which the physical control is ticked under Selectors. If you inspect any sound's Matrix settings you will find all sorts of events set up. If, for example, the MW is included and you have all Selectors ticked for the MW, then every time you move the MW, not only will the settings you have made occur (like the pitch changes in Ian's experiments) but also all the other settings Wersi has produced will happen. That may not be desirable for what you want to achieve, but it's easily adjusted by unticking the appropriate boxes in Selectors, or even editing the other Sounds you're using to remove the MW from the Matrix by setting Source and Destination to Off in the MW row(s).

You may also be wondering if there's any sequence importance to the six rows in the Matrix. There is not. Any event can go in any row and they all occur at the same time (assuming no programming delays are set up). However, events can be duplicated within the Matrix and that can lead to some interesting possibilities, as Ian now explains by looking at the Destination column in more detail.

The Destination component in more detail

In order to program/produce a useful modulation using the Matrix, it will be helpful to understand where a physical or electronic component is actually being sent/routed to: in other words, its Destination. Understanding these parameters is part of the key to getting the instrument to produce what you are after in your musical imagination.

The list of options for the Destination parameters (nine in total, plus an 'off' position), covers all of the main requirements that could be found in any synthesizer system. Each one in the list for Destination directly refers to a particular parameter on either this (Sound Factory/Matrix) page or on one of the other pages in Sound Factory currently available in this software version.

Extending the Depth beyond the numerical description - Compounded Modulation

For example, Pitch, as used in Experiment One. Using this as a Destination will make changes to the frequency range within which a sound layer will play back. If you changed the Depth numeric value you will have noticed that smaller intervals are also available/possible. You may be wondering what you need to do to get the range to go beyond an octave?

One method is to just use the same code/recipe in another free Matrix row. This was the original:

Row No.	Source	Modifier	Modify	Destination	Depth
1	Mod Wheel	Off	0%	Pitch	+100%

Copy it into Row 2 and try it.

Row No.	Source	Modifier	Modify	Destination	Depth
1	Mod Wheel	Off	0%	Pitch	+100%
2	Mod Wheel	Off	0%	Pitch	+100%

This is called Compounding and produces a Compounded Modulation. It is the addition of more than one Source being routed to the same Destination giving a wider/larger possible range of modulation.

You could fill all six available rows in the Matrix with the same code/recipe and for each row the sound will go up/down yet another octave, assuming that the sample(s) that are being selected can go that high/low. Bass sounds for example, don't normally have a six octave range, so the sample(s) are unlikely to go that far either!

What happens if we use a positive value in one row, say for example +100%, and then in another row -100%? If both rows' Destinations are the same (compounded) and both Sources are active, some simple Maths will help us predict the result:

100% + -100% = 0%. In other words we will get no change in the Pitch value. Try putting this arrangement into two rows of the matrix:

Row No.	Source	Modifier	Modify	Destination	Depth
1	Mod Wheel	Off	0%	Pitch	+100%
2	Mod Wheel	Off	0%	Pitch	-100%

Then try your MW: nothing happens! The negative modulation counteracts the positive so they cancel each other out.

Bear this in mind if you compound various Sources into a single Destination. If one source is +100% and the other -90%, when both sources are active you will get only +10% modulation as a result. This is true for most of the time. However, because of the different kinds and types of modulation available, things can get very, very complicated.

The best thing to do is try it. If it produces what you want, keep it. If it doesn't, change it.

Jeff Ormerod has provided an audio example of using the MW to provide a pipe organ Octave Coupler within one single Sound. You can download that mp3 file from the WersiClub International Sound Factory page. Here is his explanation of how he constructed the sound for that example.

Jeff's Octave Coupler Example

Following on from Ian's discussion on the use of the Modulation Wheel to control the pitch of a sound, here's an application of that principle to the implementation of an Octave Coupler as found on many pipe organs. The purpose of the Octave Coupler is to add in the octave above of all the notes from all the stops being played on the manual. So we have two pitches sounding together, the original pitch which we might call the Unison Pitch, and the Octave Pitch which has been added by the coupler, the latter leading to a considerable brightening of the sound. Although in this example we are using pipe organ sounds, the same principle can be applied to any sound or group of sounds, string ensembles being particularly suited.

For the purpose of this demonstration we shall use two sounds in combination from the Wersi Sacral expansion package, the Gedackt 8 and the Prinzipal 8. The procedure will be to use the Sound Factory to create modified versions of these sounds so that each contains an additional sample an octave higher that will be switched on and off by the Modulation Wheel as programmed by the Matrix. Here's how to do it.

1) Load the Gedackt 8 sound (060-000-007) into the Sound Factory and ensure that the Sample Tab page is selected. You will see that there are a number of other pipe organ samples on the Sample Layer list. None of these are active in the sound since they all have their volumes set to - (i.e. silence). Select the Gedackt 8 sample, make a copy of it (Layer to Clipboard), select the last sample in the list and add the copied sample to the end of the list (Paste Behind).

2) Ensure that the newly copied sample is still selected and set its Octave parameter in the Pitch section of the Sample Tab menu to +1. This raises its pitch by one octave to provide the required coupler function.

3) Now Select the LFO/Matrix Tab and add the following parameters to the next available free line in the Matrix.

Source	Modifier	Modify	Destination	Depth
Mod Wheel	Off	-0.0%	Amp	+100%

This command uses the Amp parameter (short for Amplitude) to programme the Modulation Wheel so that the volume of the copied sample can be varied from silence when in its rolled back state to full volume when in its rolled forward state. In this way we can switch on and off the Octave Coupler function as and when required.

4) Save the sound as a new Sound Factory sound and repeat the above procedure for the Prinzipal 8 sound (060-000-022).

We can now construct a Total Preset with the modified Gedackt 8 on one layer and the modified Prinzipal 8 sound on another.

There is an audio download of this sound featuring an extract from Handel's Largo (not to be confused with Handel's Lager, which sounds like it might be a brand of Bavarian Beer!!) on the Sound Factory page of the WersiClub International website. Initially you will hear just the unison sound of the Gedackt 8 and Prinzipal 8 combination with the Modulation Wheel rolled back, then later rolled forward to switch on the Octave Coupler and finally rolled back again to switch it off.

This concludes Part One of this series of Matrix Master Classes. There are more to follow. In the next one we shall deal with the remaining Destination parameters and how they work in Sound Factory.

Ian Terry
Jeff Ormerod
Colin Moore

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